IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Applicants	:	C. Harry Knowles et al.
Serial No.	:	10/084,827
Filed	:	February 27, 2002
Title of Invention	:	PROGRAMMABLE DATA ELEMENT QUEUING, HANDLING, PROCESSING AND LINKING DEVICE INTEGRATED INTO AN OBJECT IDENTIFICATION AND ATTRIBUTE ACQUISITION SYSTEM
Examiner	:	Thien Le
Group Art Unit	:	2876
Attorney Docket	:	108-151USAN80

Honorable Commissioner of Patents
and Trademarks
Washington, DC 20231

INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. 1.97

Sir:

In order to fulfill Applicants' continuing obligation of candor and good faith as set forth in 37 C.F.R. 1.56, Applicants submit herewith an Information Disclosure Statement prepared in accordance with 37 C.F.R Sections 1.97, 1.98 and 1.99.

The disclosures enclosed herewith are as follows:

U.S. PUBLICATIONS

NUMBER	FILING DATE	TITLE
6,296,187 B1	November 12, 1999	CCD-BASED BAR CODE SCANNER
6,257,490 B1	November 9, 1999	CCD-BASED BAR CODE SCANNER
6,230,975 B1	October 7, 1999	OPTICAL READER WITH ADAPTIVE EXPOSURE CONTROL
6,223,988 B1	October 14, 1997	HAND-HELD BAR CODE READER WITH LASER SCANNING AND 2D IMAGE CAPTURE
6,263,347 B1	April 28, 1999	SYSTEM FOR LINKING DATA BETWEEN COMPUTER AND PORTABLE REMOTE TERMINAL AND DATA

		LINKING METHOD THEREFOR
6,177,999 B1	August 25, 1997	DIMENSIONING SYSTEM
6,166,770	July 18, 1998	CAMERA FOCUS CONTROL ACCORDING TO EXTRACTION RANGE SIZE AND/OR ZOOM RATE
Re: 36,528	March 24, 1995	OPTICAL SCANNING HEAD
6,147,358	June 9, 1999	CCD SCANNER HAVING IMPROVED SPECULAR REFLECTION DISCRIMINATION
6,137,577	November 3, 1999	METHOD AND APPARATUS FOR MEASURING DIMENSIONS OF OBJECTS ON A CONVEYOR
6,123,264	April 8, 1997	APPARATUS AND METHOD FOR DETERMINING A DISTANCE TO A TARGET
6,069,696	June 7, 1996	OBJECT RECOGNITION SYSTEM AND METHOD
6,064,629	December 15, 1998	OBJECT DETECTION APPARATUS AND METHOD
6,053,409	June 24, 1997	DYNAMIC FOCUSING APPARATUS FOR AN OPTICAL IMAGING SYSTEM USING A DEFORMABLE MIRROR
6,049,386	October 21, 1998	IN-MOTION DIMENSIONING SYSTEM AND METHOD FOR CUBOIDAL OBJECTS
5,991,041	November 12, 1998	METHOD AND APPARATUS FOR MEASURING DIMENSIONS OF OBJECTS ON A CONVEYOR
5,988,506	June 16, 1996	SYSTEM AND METHOD FOR READING AND DECODING TWO DIMENSIONAL CODES OF HIGH DENSITY
5,986,745	March 24, 1997	CO-PLANAR ELECTOMAGNETIC PROFILE SCANNER
5,984,186	October 29, 1997	CCD-BASE BAR CODE SCANNER

5,979,760	June 27, 1997	SCANNER WITH LINEAR ACTUATOR BASED LENS POSITIONING SYSTEM
5,969,823	December 14, 1998	DIMENSIONING SYSTEM
5,923,428	July 11, 1997	METHOD AND APPARATUS FOR MEASURING DIMENSIONS OF OBJECTS ON A CONVEYOR
5,900,611	June 30, 1997	LASER SCANNER WITH INTEGRAL DISTANCE MEASUREMENT SYSTEM
5,889,550	June 10, 1996	CAMERA TRACKING SYSTEM
5,870,220	July 12, 1996	PORTABLE 3-D SCANNING SYSTEM AND METHOD FOR RAPID SHAPE DIGITIZING AND ADAPTIVE MESH GENERATION
5,869,827	August 15, 1997	MULTIPLE WINDOW SCANNER AND METHOD FOR MULTIPLE FOCAL DISTANCE READING
5,850,370	February 11, 1997	LASER-BASED DIMENSIONING SYSTEM
5,831,220	April 22, 1997	AUTOMATED PACKAGE SHIPPING MACHINE
5,831,737	June 2, 1997	IN MOTION DIMENSIONING SYSTEM FOR CUBOIDAL OBJECTS
5,814,802	February 23, 1996	HIGH SPEED IMAGING APPARATUS FOR CCD BASED SCANNERS
5,786,582	December 8, 1995	OPTICAL SCANNER FOR READING AND DECODING ONE- AND TWO DIMENSIONAL SYMBOLOGIES AT VARIABLE DEPTHS OF FIELD
5,737,438	March 7, 1994	IMAGE PROCESSING
5,717,919	October 2, 1995	DATABASE SYSTEM WITH METHODS FOR APPENDING DATA RECORDS BY PARTITIONING AN OBJECT INTO MULTIPLE PAGE CHAINS

5,710,417	June 2, 1995	BAR CODE READER FOR READING BOTH ONE DIMENSIONAL AND TWO DIMENSIONAL SYMBOLOGIES WITH PROGRAMMABLE RESOLUTION
5,672,858	June 30, 1994	APPARATUS AND METHOD FOR READING INDICIA USING CHARGE COUPLED DEVICE AND SCANNING LASER BEAM TECHNOLOGY
5,699,161	July 26, 1995	METHOD AND APPARATUS FOR MEASURING DIMENSIONS OF OBJECTS ON A CONVEYOR
5,689,092	June 12, 1996	CONVEYOR FRICTION SCALE
5,661,561	June 2, 1995	DIMENSIONING SYSTEM
5,656,799	April 29, 1994	AUTOMATED PACKAGE SHIPPING MACHINE
5,634,124	May 25, 1995	DATA INTEGRATION BY OBJECT MANAGEMENT
5,633,487	December 15, 1995	MULTI-FOCAL VISION SYSTEM
5,621,203	June 30, 1994	METHOD AND APPARATUS FOR READING TWO-DIMENSIONAL BAR CODE SYMBOLS WITH AN ELONGATED LASER LINE
5,615,003	November 29, 1994	ELECTROMAGNETIC PROFILE SCANNER
5,600,119	October 13, 1995	DUAL LINE LASER SCANNING SYSTEM AND SCANNING METHOD FOR READING MULTIDEMENSIONAL BAR CODES
5,596,745	May 16, 1994	SYSTEM AND PROCEDURE FOR CONCURRENT DATABASE ACCESS BY MULTIPLE USER APPLICATIONS THROUGH SHARED CONNECTION PROCESSES
5,581,067	October 20, 1994	COMPACT BAR CODE SCANNING

		MODULE WITH SHOCK PROTECTION
5,555,090	October 24, 1994	SYSTEM FOR DIMENSIONING OBJECTS
5,547,034	January 10, 1994	CONVEYOR FRICTION SCALE
5,543,610	April 15, 1994	COMPACT BAR CODE SCANNING ARRANGEMENT
5,532,467	00/00/00	OPTICAL SCANNING HEAD
5,504,879	July 16, 1992	RESOLUTION OF RELATIONSHIP SOURCE AND TARGET IN A VERSIONED DATABASE MANAGEMENT SYSTEM
5,495,097	September 14, 1993	PLURALITY OF SCAN UNITS WITH SCAN STITCHING
5,448,727	April 30, 1991	DOMAIN BASED PARTITIONING AND RECLUSTERING OF RELATIONS IN OBJECT-ORIENTED RELATIONAL DATABASE MANAGEMENT SYSTEMS
5,412,198	November 8, 1991	HIGH-SPEED SCANNING ARRANGMENT WITH HIGH-FREQUENCY LOW-STRESS SCAN ELEMENT
5,378,883	July 19, 1991	OMNIDIRECTIONAL WIDE-RANGE HAND HELD BAR CODE READER
5,373,148	September 10, 1992	OPTICAL SCANNERS WITH SCAN MOTION DAMPING AND ORIENTATION OF ASTIGMANTIC LASER GENERATOR TO OPTIMIZE READING OF TWO-DIMENSIONALLY CODED INDICIA
5,331,118	November 27, 1992	PACKAGE DIMENSIONAL VOLUME AND WEIGHT DETERMINATION SYSTEM FOR CONVEYORS
5,329,103	October 30, 1991	LASER BEAM SCANNER WITH LOW COST DITHERER MECHANISM
5,319,185	July 24, 1992	SMALL-SIZE HAND-SUPPORTED BAR CODE READER

5,319,181	March 16, 1992	METHOD AND APPARATUS FOR DECODING TWO-DIMENSIONAL BAR CODE USING CCD/CMD CAMERA
5,296,690	September 26, 1991	SYSTEM FOR LOCATING AND DETERMINING THE ORIENTATION OF BAR CODES IN A TWO-DIMENSINAL IMAGE
5,280,165	April 14, 1992	SCAN PATTERN GENERATORS FOR BAR CODE SYMBOL READERS
5,224,088	February 10, 1992	HIGH RESOLUTION OPTICAL SCANNER
5,220,536	February 28, 1992	MEASURING METHOD AND APPARATUS
5,212,390	May 4, 1992	LEAD INSPECTION METHOD USING A PLANE OF LIGHT FOR PRODUCING REFLECTED LEAD IMAGES
5,193,120	February 27, 1991	MACHINE VISION THREE DIMENSIONAL PROFILING SYSTEM
5,192,856	November 19, 1990	AUTO FOCUSING BAR CODE READER
5,168,149	May 8, 1990	SCAN PATTERN GENERATORS FOR BAR CODE SYMBOL READERS
5,136,145	August 28, 1990	SYMBOL READER
5,080,456	February 26, 1990	LASER SCANNERS WITH EXTENDED WORKING RANGE
5,076,690	May 14, 1990	COMPUTER AIDED POSITIONING SYSTEM AND METHOD
4,979,815	February 17, 1989	LASER RANGE IMAGING SYSTEM BASED ON PROJECTIVE GEOMETRY
4,958,894	January 23, 1989	BOUNCING OSCILLATING SCANNING DEVICE FOR LASER SCANNING APPARATUS
4,904,034	January 29, 1988	SCANNING APPARATUS

4,900,907	March 18, 1987	OPTICAL INFORMATION READING APPARATUS
4,826,299	January 30, 1987	LINEAR DEIVERGING LENS
4,717,241	June 11, 1985	LIGHT DEFLECTION DEVICE
4,687,325	March 28, 1985	THREE-DIMENSIONAL RANGE CAMERA
4,632,501	February 16, 1984	RESONANT ELECTROMECHANICAL OSCILLATOR
4,580,894	June 30, 1983	APPARATUS FOR MEASURING VELOCITY OF A MOVING IMAGE OR OBJECT
4,387,297	February 29, 1980	PORTABLE LASER SCANNING SYSTEM AND SCANNING METHODS
4,333,006	December 12, 1980	MULTIFOCAL HOLOGRAPHIC SCANNING SYSTEM
4,063,287	February 23, 1976	TRACKING MIRROR DEVICE FOR A VIDEO DISC PLAYER
4,044,283	October 22, 1975	ELECTROMECHANICAL RESONATOR
3,947,816	July 1, 1974	OMNIDIRECTIONAL OPTICAL SCANNING APPARATUS
3,671,766	June 29, 1970	OSCILLATING MECHANISM

FOREIGN PUBLICATIONS

NUMBER	PUBLICATION DATE	TITLE
WO 01/71419 A2	September 27, 2001	LARGE DEPTH OF FIELD LINE SCAN CAMERA
WO 01/72028 A1	September 27, 2001	COPLANAR CAMERA SCANNING SYSTEM
WO 00/75856	December 14, 2000	UNITARY PACKAGE IDENTIFICATION

		AND DIMENSIONING SYSTEM EMPLOYING LADAR-BASED SCANNING METHODS
60/190,273	May 29, 2001	COPLANAR CAMERA
WO 99/64980	December 16, 1999	IMAGING ENGINE AND METHOD FOR CODE READERS
WO 97/22082	June 19, 1997	MULTI-FOCAL VISION SYSTEM
GB 2 189 594 A	October 28, 1987	OPTOELECTRONIC MEASUREMENT OF PACKAGE VOLUME

TECHNICAL PUBLICATIONS

Product Brochure for "Model 120 LIVAR® Short Wave IR Gated Camera Specification" from Intevac Corporation, Santa Clara, California pages 1-7.

Weblink to "New LIVAR® Imagery" from Intevac Corporation, Santa Clara, California (http://www.intevac.com/livar_imagery/livar_imagery.html.) pages 1-9.

Product Brochure for "Lasiris SNF Laser" from StockerYale Corporation, Salem, New Hampshire pages 1-4.

Product Brochure for "AV3700 High Speed CCD Bar Code Reader" by Accu-Sort® Systems, Inc., Telford, Pennsylvania pages 1-2.

Product Brochure for "DALSA IT-P4 Image Sensors" from Dalsa, Inc., Waterloo, Ontario, Canada, pages 1-14.

Product Brochure for "KAF-4202 Series" from Eastman Kodak Company, Rochester NY, Revision 1, pages 1-15, June 29, 2000.

User's Manual for "Piranha CT-P4, CL-P4 Camera" from Dalsa, Inc., Waterloo, Ontario, Canada, (Pages 1-30).

Product Brochure for "Sony ICX085AL 2/3-inch Progressive Scan CCD Image Sensor" from Sony Corporation pages 1-20.

Product Brochure for "ML1XX6 Series Laser Diodes for Optical Information Systems" by Mitsubishi Electric, pages 1-4, December 1999.

Web-based Product Brochure for the Accu-Sort Tunnel Scanning System,

http://www.accusort.com/mktg/as01.html, 2001, pages 1-2.

Product Brochure for "The MINI-X" by Accu-Sort, Inc., Telford, PA, January 1998, pages 1-2.

Scientific Publication entitled "Omni-Scan Tunnel" by the U.S. Postal Service, January 12, 1997, pages 1-18.

Scientific Publication entitled "Dimensioning the Right Way: Reliably" by Cargoscan A/S, September 10, 1998, pages 1-16.

INTERNATIONAL SEARCH REPORTS

App. No.	Filing Date
PCT/US00/15624	August 9, 2000

STATEMENT OF PERTINENCE

U.S. Patent No. 6,296,187 B1 to Shearer discloses a bar code scanning system for a conveyor system which includes a CCD camera that writes data to a memory. Data is stored in the memory as a two-dimensional image at periodic time frames based on scanning by the CCD camera. Data is written out of the memory by a controller, to create a virtual X-scan pattern, that can be read and decoded by a decoder that is configured to decode X-scan patterns. Alternatively, the memory can be configured as a first memory region for receiving even pixel data, and a second memory region for receiving odd pixel data.

U.S. Patent No. 6,263,347 B1 to Kobayashi et al. discloses a data linking method of extracting data of a host data base on a computer into a portable remote terminal, containing an item definition data base which defines a record attribute, an object storage data base which stores object data on a record basis, a relation definition data base which defines relations among object data and a definition data base which defines relations among the respective data bases, and conducts synchronous processing of writing. The portable remote terminal conducts link data solution processing based on a record attribute of the item definition data base when a record item of the object storage data base refers to another object storage data base, and changes, when the display order of object data of the object storage data base is changed or when existence/non-existence of display is selected, the display order of object data of said item definition data base or an attribute indicative of existence/non-existence of display according to the contents of the change or the selection, and the computer further reads an updated record from said object storage data base of the portable remote terminal to update the host data base.

U.S. Patent No. 6,257,490 B1 to Tafoya discloses a bar code scanning system for a

conveyor system in which a first conveyor and a second conveyor are disposed apart from each other by a small gap region. A light emitting device is positioned in the gap underneath a top surface of the first and second conveyors, and the light emitting device shines light onto bar code labels on a bottom side of objects as the objects traverse from the first conveyor to the second conveyor. A light receiving device is also positioned in the gap, and the light receiving device receives reflected light from the bottom side of the objects due to the light being shined on the objects by the light emitting device. The gap is covered by a glass or plastic plate, so as to allow light to pass substantially therethrough.

U.S. Patent No. 6,230,975 B1 to Colley et al. discloses an optical or symbol reader including CMOS circuitry preferably integrated on a single chip. A CMOS optical reader chip comprises a CMOS imaging array having a plurality of pixels each with a dedicated pixel-site circuit. Charge is accumulated at each pixel location transferred upon demand to a common bus. In a preferred embodiment, exposure time of the imaging array is controlled using a feedback loop. One or more exposure control pixels are positioned adjacent to or within the imaging array and receive light along with the imaging array. The charge of the exposure control pixel or pixels is measured against a threshold level, and the amount of time taken to reach the threshold level determines the time exposure of the pixels of the imaging array. CMOS signal processing circuitry is employed which, in combination with the exposure control circuitry, minimizes time-to-read over a large range of light levels, while performing spatially optimal filtering. Clocking cycles and control signals are time-adjusted in accordance with the varying output frequency of the imaging array so as to provide invariant frequency response by the signal processing circuitry. A multi-dimensional CMOS imaging array is also provided having simultaneous pixel exposure with non-destructive readout of the pixel contents.

U.S. Patent No. 6,223,988 B1 to Batterman et al. discloses a hand-held bar code reader which includes a laser scanning module and a two dimensional image sensor and processor for reading a bar code. The laser scanner assists the 2D image processing by providing information on location, type, range, reflectivity, and presence of bar code for 2D reading. Additionally, the 2D image reading operation is improved by using the laser scan as a spotter beam for aiming.

U.S. Patent No. 6,177,999 B1 to Wurz et al. discloses a dimensioning system for determining the minimum size box necessary to enclose an object traveling on a moving conveyor. The dimensioning system is comprised of a light source which generates a scan beam that is moved by a mirrored wheel. A line scan camera whose field of view tracks the moving scan beam receives images of the scan beam and outputs a signal which is processed to compute a three dimensional box structure of the scanned object.

U.S. Patent No. 6,166,770 to Yasuda discloses an image pickup apparatus with a focus detecting device for detecting a state of focus from a picked-up image signal outputted from an image sensor, and an electronic zoom device for electrically magnifying the picked-up image signal. The image pickup apparatus is arranged to control an operation characteristic of the focus detecting device on the basis of the operating state of the electronic zoom device.

U.S. Patent No. RE. 36,528 to Roustaei discloses the design for a bar code scanner using the Light Emitting Diode (LED), Optical Scanner assembly and Charge-Coupled Devices (CCD) capable of reading the barcode symbols at the variable distance. An optical passive element for increasing the depth of field and a method of fabricating the scanning head by mass-production techniques are also disclosed.

U.S. Patent No. 6,147,358 to Hecht discloses an overhead bar code scanning system mounted over a conveyor belt structure. The system utilizes two linear CCD detectors and a bandpass filter structure to improve the ability of the scanner to discriminate against specular reflection. A coded symbology is illuminated by a noncoherent light source and light reflected from the coded symbology along a first path strikes the front face of the bandpass filter. The bandpass filter, functioning as a notch filter, transmits a select bandwidth of light while reflecting all other light onto a first CCD detector. Simultaneously, light reflected from the bar code symbol travels along a second path, at a different angle with respect to the plane of the coded symbology than the first path, is reflected from a mirror onto the back face of the bandpass means. The bandpass filter transmits the select bandwidth of light onto a second CCD detector and reflects all other light. The second CCD detector has a notch filter which permits the detection of only the select bandwidth.

U.S. Patent No. 6,137,577 to Woodworth discloses a method and apparatus for measuring the length, width and height of rectangular solid objects moving on a conveyor. The apparatus includes a light curtain, two laser triangulation range finders, and a pulse tachometer mounted on a frame around a conveyor. As an object is conveyed through the frame, measurements from each of the sensors are correlated by a digital computer to estimate the length, width and height of the object. The method and apparatus does not require a break in the surface of the conveyor, and is insensitive to object placement and orientation on the conveyor.

U.S. Patent No. 6,123,264 to Li et al. discloses a range finder for use with a bar code scanning system. An image of a scan line is detected by a CCD sensor array. Distance from the scanner to the bar code symbol is determined from the length of the detected scan line image on the CCD sensor array.

U.S. Patent No. 6,069,696 to McQueen et al. discloses an object recognition system which comprises a sensing apparatus for collecting light reflected from objects presented at a point-of-sale machine. The sensing apparatus includes a mechanism, such as a holographic disk or diffraction grating, for separating the color components of the light reflected from the object and directing, the color components onto an optical detector such as a two-dimensional imaging array, or a one-dimensional imaging array or single photo-sensitive optical cell used in conjunction with a rotating mirror. A pattern recognizer compares the spectral response, including the locations, amplitudes and widths of energy peaks of the different color components, against premeasured characteristics of known objects in order to classify the object. The weight of the object can be measured with a scale, and the density of the object calculated, with the weight and density being used by the pattern recognizer to further classify the object. In one embodiment, a plurality of narrowband illumination sources are operated in time-sequential manner, each illuminating with a different wavelength band of light, in order to allow separate color measurements. The object recognition system may be integrated in a single unit along with an optical code reader, and may share all or part of the same exit aperture therewith. The object recognition system may include thermal detection or a particle source and secondary emission detection device, either alone or in conjunction with other object recognition means.

U.S. Patent No. 6,064,629 to Stringer et al. discloses a method and apparatus for ensuring accuracy of weight measurement of objects on a conveyor and providing security against pilferage or miscoding of the objects. A series of sensors such as photocells linked to a process control unit sense passage of objects to respectively activate a scale and cubing system associated with the conveyor, to release an additional object for weighing and cubing, to sense overlong objects exceeding the length of the scale, and to detect when an object has been stolen or otherwise removed (as by falling off) the conveyor between various locations through the use of programmed timing "windows" between the various sensors. If an object does not trigger a sensor within the window measured from passage past a preceding sensor, an error message is generated.

U.S. Patent No. 6,053,409 to Brobst et al. discloses in Fig. 11, a tunnel laser scanning system which employs apparatus for increasing the depth of the field of the optical scanning mechanism contained therein. The apparatus is optically located between a laser source and a scan mirror and includes a plurality of alternating curved and flat facets. Alternatively, a piezoelectric deformable mirror may be optically located between the laser source and a flat faceted scan mirror to provide for increased depth of field of the optical scanning mechanism.

U.S. Patent No. 6,049,386 to Stringer et al. discloses an in-motion measuring system for determining the length and width of linearly-moving cuboidal objects through the use of object speed, the times during which six light beams oriented across the path of the object are obstructed

by the object, and the angles of the light beams with respect to the direction of object movement. The height of an object may also be determined through use of a vertically-extending light curtain with horizontally-oriented light beams, or via an ultrasonic sensor.

U.S. Patent Nos. 5,991,041, 5,923,428 and 5,699,161, all to Woodworth disclose a system for measuring the length, width, and height of rectangular solid objects moving on a conveyor. The system includes a light curtain, two laser triangulation range finders, and a pulse tachometer mounted on a frame around a conveyor. As an object is conveyed through the frame, measurements from each of the sensors are correlated by a digital computer to estimate the length, width and height of the object. As disclosed, the method and system does not require a break in the surface of the conveyor, and is insensitive to object placement and orientation on the conveyor.

U.S. Patent No. 5,988,506 to Schaham et al. discloses a system for reading two dimensional codes as well as regular bar codes. A laser scanner generates a narrow horizontal beam which scans a code by means of a scanning mirror in the vertical direction. This mirror receives the reflected beam and passes it on to the lens array to yield high quality imaging characteristics all across a large field of view angle. The lens array and an auto focusing system produce images of the scanning lines in the sensor plane - a CCD linear array. In the sensor's plane, sub aperture diaphragms generate partially overlapping fields of view from each of the elements of the lens array. The system electronics converts the CCD linear array electrical signals into digital data. A module synthesizes in real-time the partially overlapping line sections of the image signal into an integrated continuous line signal and stores them consecutively in the image memory. A system processor operates an autofocus, as well as code classification and decoding algorithms.

U.S. Patent No. 5,986,745 to Hermary et al. discloses a co-planar system for determining the shape and dimensions of a surface of an object which includes a projector for projecting a spatially coded pattern of radiation, e.g., light, in a selected plane onto the object. The system also includes a receiving device capable of imaging the reflected pattern in the selected plane, and a discriminator for determining which portion of the reflected pattern corresponds to which portion of the projected pattern. By this means, a received signal representing less than the complete reflection from the projected pattern can be correlated with a discrete portion of the scanned object. The object is moved relative to the selected plane and the procedure repeated to obtain enough reliable data to generate a reasonably reliable surface profile. The resulting set of received signals and correlations are used to calculate the shape and dimensions of the object.

U.S. Patent No. 5,984,186 to Tafoya discloses a CCD bar code scanning system for use with a conveyor system, in which a first conveyor and a second conveyor are disposed apart from

each other by a small gap region. A light emitting device is positioned in the gap underneath a top surface of the first and second conveyors, and the light emitting device shines light onto bar code labels on a bottom side of objects as the objects traverse from the first conveyor to the second conveyor. A light receiving device is also positioned in the gap, and the light receiving device receives reflected light from the bottom side of the objects due to the light being shined on the objects by the light emitting device. The gap is covered by a glass or plastic plate, so as to allow light to pass substantially therethrough.

U.S. Patent No. 5,979,760 to Freyman et al. discloses in Fig. 11B, a four-zone tunnel-type scanning system for reading bar code symbologies using a focusing illuminating source. The scanner uses a coherent light source for illuminating the coded symbol during a scan and a detector for collecting the reflected light energy from the coded symbol. Both the illuminating and collecting devices include lenses which are in variable spatial relationship with each other. The scanner varies the relationship between the light source and associated focusing lens to provide the narrowest focused beam at the barcode location.

U.S. Patent Nos. 5,969,823 and 5,661,561 to Wurz et al. disclose a dimensioning system for determining the minimum size box necessary to enclose an object traveling on a moving conveyor. The dimensioning system comprises a light source which generates a scan beam that is moved by a mirrored wheel. A line scan camera, whose telecentric field of view tracks the moving scan beam, receives images of the scan beam and outputs a signal which is processed to compute a three dimensional box structure of the scanned object.

U.S. Patent No. 5,923,428 to Woodworth discloses a method and apparatus for measuring the length, width and height of rectangular solid objects moving on a conveyor. The apparatus includes a light curtain, two laser triangulation range finders, and a pulse tachometer mounted on a frame around a conveyor. As an object is conveyed through the frame, measurements from each of the sensors are correlated by a digital computer to estimate the length, width and height of the object. The method and apparatus does not require a break in the surface of the conveyor, and is insensitive to object placement and orientation on the conveyor.

U.S. Patent No. 5,900,611 to Hecht discloses a one-sided tunnel scanning system for reading coded symbologies, using a coherent, visible light source for illuminating the coded symbol during a scan and a detecting means for collecting the reflected light energy from the coded symbol. The system also employs an invisible light source illuminating the coded symbol during the scan and a one-dimensional position-sensitive detector whose field of view receives images of the illuminating beam. The position-sensitive detector outputs a current which is processed to detect the presence and compute the distance of an object being scanned. Both the

visible and invisible light sources from the scanner travel along a shared, coaxial path to and from the object.

U.S. Patent No. 5,889,550 to Reynolds discloses a camera tracking system which determines the three dimensional (3D) location and orientation of the film plane of a camera providing live recording of a subject, thereby defining a 3D coordinate system of the live action scene into which animated objects or characters may be automatically mapped with proper scale and 3D visual object by a computer animation system.

U.S. Patent No. 5,870,220 to Migdal et al. discloses a portable 3D scanning system that collects 2D-profile data of objects using a combination of a laser-stripe positioning device and a video camera which detects the images of the laser stripe reflected from the object. The scanning system includes a laser-stripe generator, a video camera, a scanning mirror attached to a continuously rotating motor, an encoder or a photodiode operationally coupled to the motor, and associated electronics. As the rotating scanning mirror reflects the laser stripe and variably positions the laser stripe across the object, the encoder or the photodiode generates signals indicating the angular position of the mirror. The video images of the reflected laser stripes are stored on a storage medium, while data relating to the angular positions of the laser stripes recorded in the video images are simultaneously stored on a storage medium. A computer subsequently synchronizes and processes the recorded laser stripe data with the angular-position data to generate a 3D model of the object by applying triangulation calculation and other post-scanning methods, e.g., multi-resolution analysis and adaptive-mesh generation. The multi-resolution analysis, which applies more points to resolve fine details and fewer points for smooth regions of the objects, leads to significant data compression. The adaptive mesh, which includes connected polygonal elements and which may have multiple resolutions and tolerances, is generated by the adaptive-mesh generating routine.

U.S. Patent No. 5,869,827 to Rando discloses a multiple window bar code reading system for reading bar codes through each window. The field of view of each window is focused to different focal distances in the scan volume using sensors that control focal distance setting from each window.

U.S. Patent No. 5,850,370 to Stringer et al. discloses a method and apparatus for measuring the dimensions and determining the three-dimensional, spatial volume of objects, particularly small objects. Reflected laser light sensors are employed. A stationary measurement embodiment of the apparatus may be employed to measure regular cuboidal objects. A dynamic or in-motion embodiment may be employed to measure the dimensions of cuboidal objects or a three-dimensional outline of objects of irregular configuration.

U.S. Patent No. 5,831,220 to Ramsden et al. discloses a system for accepting and storing items for subsequent pickup by a commercial carrier which includes a storage area defined by an outer housing, and a customer interface area that includes a weighing unit and a unit, such as a magnetic card reader, for accepting payment from a customer. The system may also include a control system that accepts address information from the customer through a key pad, and then instructs a printer to print an address label for the item. The system includes safeguards which prevent unauthorized access to the storage area, and will not provide a receipt to the customer until internal sensors verify deposit of the item. A manifest printer may also be provided for the benefit of the commercial carriers who service the system, to print out a summary of the transactions that pertain to each carrier. Alternatively, no storage area is provided. Instead, the item is given to a human attendant, such as a checkout clerk of a grocery or hardware store and the like, with the appropriate mailing label for validation of receipt of the item by the attendant.

U.S. Patent No. 5,831,737 to Stringer et al. discloses an in-motion measuring system for determining the length and width of linearly-moving cuboidal objects through the use of object speed, the times during which four light beams oriented across the path of the object are obstructed by the object, and the angles of the light beams with respect to the direction of object movement. The height of an object may also be determined through use of a vertically-extending light curtain with horizontally-oriented light beams, or via an ultrasonic sensor.

U.S. Patent No. 5,814,802 to Hecht et al. discloses in Fig. 4, a CCD based tunnel scanning system which comprises a housing having separate compartments with modular assemblies installed therein. A decoder compartment houses components associated with locating and decoding an image. An optics compartment houses the mirrors and associated optics for reflecting the subject image onto the CCD detector. A lighting compartment includes high intensity lamps and the associated components for illuminating an object to be imaged. The lighting compartment includes a heat management system which removes the heat from the high intensity lamps and prevents heat from migrating to other compartments within the housing.

U.S. Patent No. 5,786,582 to Roustaei et al. discloses an optical device for reading one- and two-dimensional symbologies at variable depths of field, the device including a light source for projecting an emitted light beam towards the two-dimensional image and an optical assembly, or zoom lens, with dual field of view capability for focusing light reflected from the framed symbology onto a CCD detector for detecting the focused light and generating a signal therefrom. The dual field of view capability enables scanning of both wide and narrow fields of view. An apodizing filter is provided within the optical assembly to increase depth of field. Aiming of the sensor to read the symbology is facilitated by a frame locator including a laser diode which emits a

beam that is modified by optics, including diffractive optics, to divide the beam into beamlets having a spacing therebetween that expands to match the dimensions of the field of view of the sensor, forming points of light at the target to define the edges of the field of view. One or two sets of diffractive optics may be provided, with one set corresponding to each position, for each of the dual field of view positions of the zoom lens.

U.S. Patent No. 5,737,438 to Zlotnick et al. discloses in Fig. 1, an image-based tunnel system for locating labels on images of parcels.. As disclosed, the system comprises apparatus for generating and storing in digital form, an image of the parcel comprising pixels arranged in rows and columns; classification logic for classifying each pixel as either a label pixel, a background pixel or neither, based on the pixel color; segmentation logic for reclassifying each pixel as either label or background based on its original classification and the classification of pixels in its neighborhood; and identification logic for identifying the boundaries of regions in which all pixels are classified as label pixels.

U.S. Patent No. 5,717,919 to Kodavalla et al. discloses a client/server database system with improved methods for appending items to an object, such as appending data records to a database table, in the context of a multi-user environment is described. The system includes one or more clients (e.g., terminals or PCs) connected via a network to a server. The clients store data in a retrieve data from one or more database tables resident on the server by submitting SQL commands, some of which specify insert or append operations, for appending records to a table. For enhancing the speed in which multiple appenders (i.e., clients) can append records, the operation of the server is modified to store an object (e.g., table) as multiple (physical) page chains. From the logical viewpoint, a single (logical) page chain of data pages is presented to each client or user. From the perspective of inserting records, however, the system has multiple page chains to insert into, thereby removing contention among multiple appenders for the last page.

U.S. Patent No. 5,710,417 to Joseph et al. discloses hand-held linear images, in which a plurality of the areas of differing light reflectivity of a bar code symbol or the like which are simultaneously illuminated using, for example, a beam of light that has an elongated cross-section. The light beam is swept over the symbol to be read in a direction transverse to the elongated dimension of the illuminated region so that a two-dimensional area of the symbol is illuminated over time. The reflected light is sensed by a 1D CCD array. A microprocessor within the scanner provides visual feedback to aid a user in aligning the device, and also provides for a selectable aspect ratio for the image, a selectable image resolution and size, a selectable aspect ratio of the illumination, and a selectable pixel size. All of these options may be programmed within the microprocessor, enabling the device to read a large variety of two-dimensional symbols.

U.S. Patent No. 5,699,161 to Woodworth discloses a method and apparatus for measuring the length, width, and height of rectangular solid objects moving on a conveyor. The apparatus includes a light curtain, two laser triangulation range finders, and a pulse tachometer mounted on a frame around a conveyor. As an object is conveyed through the frame, measurements from each of the sensors are correlated by a digital computer to estimate the length, width and height of the object. The method and apparatus does not require a break in the surface of the conveyor, and is insensitive to object placement and orientation on the conveyor.

U.S. Patent No. 5,689,092 to Wurz et al. discloses a conveyor scale assembly for use in combination with a conveyor belt for weighing an article on the moving conveyor belt. The conveyor scale assembly is comprised of a slider bed which contacts the underside of the moving conveyor belt which generates a friction force between the conveyor belt and the slider bed. Attached to the slider bed is a sensor which continuously measures the friction force and transmits data representing the measured friction force. A CPU receives and processes the representative data and provides a weight for the article on the conveyor belt.

U.S. Patent No. 5,672,858 to Li et al. discloses a scanning device for reading indicia of differing light reflectivity, including bar code or matrix array symbols, which has a single light emitter, such as a laser or light emitting diode, for generating a scanning light beam to visually illuminate sequential portions of the indicia. A sensor, such as a charge coupled device (CCD) or other solid state imaging device, simultaneously detects light reflected from portions of the indicia and generates an electrical signal representative of the spatial intensity variations of the portions of the indicia. The scanning device may also include an ambient light sensor, and a second light emitter for use only in aiming or orienting the scanning device. A photodetector may also be provided to separately detect one symbol virtually simultaneous with the detection of another symbol by the sensor or to provide dual modalities. A method for reading indicia is also provided.

U.S. Patent No. 5,661,561 to Wurz et al. discloses a dimensioning system for determining the minimum size box necessary to enclose an object traveling on a moving conveyor. The dimensioning system is comprised of a light source which generates a scan beam that is moved by a mirrored wheel. A line scan camera whose field of view tracks the moving scan beam receives images of the scan beam and outputs a signal which is processed to compute a three dimensional box structure of the scanned object.

U.S. Patent No. 5,656,799 to Ramsden et al. discloses a system for accepting and storing items for subsequent pickup by a commercial carrier that includes a storage area which is defined by an outer housing, and a customer interface area that includes a weighing unit and a unit, such as a magnetic card reader, for accepting payment from a customer. The system may also include a

control system that accepts address information from the customer through a key pad, and then instructs a printer to print an address label for the item. The system includes safeguards which prevent unauthorized access to the storage area, and will not provide a receipt to the customer until internal sensors verify deposit of the item. A manifest printer may also be provided for the benefit of the commercial carriers who service the system, to print out a summary of the transactions that pertain to each carrier. Alternatively, no storage area is provided. Instead, the item is given to a human attendant, such as a check out clerk of a grocery or hardware store and the like, with the appropriate mailing label for validation of receipt of the item by the attendant.

U.S. Patent No. 5,634,124 to Khoyi et al. discloses an object based data processing system including an extensible set of object types and a corresponding set of "object managers" wherein each object manager is a program for operating with the data stored in a corresponding type of object. The object managers in general support at least a standard set of operations. Any program can effect performance of these standard operations on objects of any type by making an "invocation" request. In response to an invocation request, object management services identifies and invokes an object manager that is suitable for performing the requested operation on the specified type of data. A mechanism is provided for linking data from one object into another object. An object catalog includes information about both objects and links between objects. Data interchange services are provided for communicating data between objects of different types, using a set of standard data interchange formats. A matchmaker facility permits two processes that are to cooperate in a data interchange operation identify each other and to identify data formats they have in common. A facility is provided for managing shared data "resources", customized versions of resources can be created and co-exist with standard resources. A resource retrieval function determines whether a customized or a standard resource is to be returned in response to each request for a resource.

U.S. Patent No. 5,633,487 to Schmutz et al. discloses a multi-focal machine-vision system that images bar code labels moving through a horizontal plane at variable object distances within the system's object depth of field with a plurality of sequential line images, each with different object lengths which gradate into plural focused object planes, and the object plane within which the bar code label lies provides a focused optical image of the bar code to a multilinear photodetector which transduces the focused optical image into a corresponding electrical signal for further processing.

U.S. Patent No. 5,621,203 to Swartz et al. discloses a plurality of the areas of different light reflectivity of a bar code symbol, or the like, which are simultaneously illuminated using, e.g., a beam of laser light that has an elongated cross-section. The laser light beam is swept over the symbol in a direction transverse to the elongated dimension of the illuminated region so that a

two-dimensional area of the symbol is illuminated over time, until the symbol is read. The light that reflects from the illuminated region of the symbol is imaged on a linear sensor array, which is then scanned or read out to produce signals representative of spatial intensity variations of the imaged light along a linear path in the field of view.

U.S. Patent No. 5,615,003 to Hermary et al. discloses a system for determining the shape and dimensions of a surface of an object which includes a projector for projecting onto the object a spatially coded pattern radiation, e.g., light. The system also includes a receiving device capable of imaging the reflected pattern, and a discriminator for determining which portions of the reflected pattern corresponds to which portion of the projected pattern. By this means, a received signal representing less than the complete reflection from the projected pattern can be correlated with a discrete portion of the scanned object. The procedure is repeated to obtain enough reliable data to generate a reasonably reliable surface profile. The resulting set of received signals and correlations are used to calculate the shape and dimensions of the object.

U.S. Patent No. 5,600,119 to Dvorkis et al. discloses a system for reading bar code symbols or the like, having a scanner for generating a laser beam directed toward a target and producing a first narrowly spaced apart dual line scanning pattern that enables the user to manually aim and direct the beam to the location desired by the user and a relatively wider spaced apart dual line second scanning pattern that sweeps an entire symbol to be read, and a detector for receiving reflected light from such symbol to produce electrical signals corresponding to data represented by such symbol.

U.S. Patent No. 5,596,745 to Lai et al. discloses a system for managing database connections between concurrent user applications and a plurality of databases in a database processing system. This method minimizes the number of connections made to a database by allowing such connections to be shared by multiple applications. The concept of a shared versus exclusive connection is introduced and, depending on the user application, a connection manager automatically routes a database access request through either an existing shared connection or an exclusive connection. A single database access object is introduced that includes two types of methods for connecting to a specified database in two different simultaneous paths. First, a shared connection through a catalog server process is made to process schema query requests for definition retrieval. Secondly, another connection is made to retrieve and manipulate data from the database responsive to SQL execution requests. Importantly, the SQL execution path itself may be either exclusive or shared with other associated database access objects requesting SQL execution in the same database.

U.S. Patent No. 5,581,067 to Grosfeld et al. discloses a scanner module for use in a bar

code reader which has a scanning mirror which is mounted to a bracket by way of leaf-spring, allowing the mirror to oscillate in one direction. The bracket is hung from a stationary chassis by means of two strips of mylar film, allowing the entire bracket to oscillate in the perpendicular direction, thereby providing two dimensional oscillation of the mirror and raster scanning of a light beam reflected from the mirror. The mylar sheets are protected against mechanical shock by pins which pass through holes in the bracket. The pins are slightly smaller than the holes, allowing sufficient clearance for movement of the bracket during normal operation, but preventing too much stress being placed upon the mylar films if the module is dropped. The pins also provide accurate alignment of the bracket with respect to the chassis.

U.S. Patent No. 5,555,090 to Schmutz discloses a system for measuring the height of an object having an outer surface. The system comprises a system for generating an energy beam along a path, such as light, having a structured pattern, wherein the structured pattern of the energy beam irradiates the outer surface of the object. The structured light pattern comprises a constant dimension. The system further comprises a sensor for sensing the outer surface of the object irradiated by the structured pattern. The system comprises a system for calculating the height of the object in response to the constant dimension of the structured pattern irradiating the outer surface of the object and sensed by the sensor. This system for calculating the height of the object preferably comprises a programmed computer containing a series of algorithmic steps for deriving a refined overall height profile of the object.

U.S. Patent No. 5,547,034 to Wurz et al. discloses a conveyor scale assembly for use in combination with a conveyor belt for weighing an article on the moving conveyor belt. The conveyor scale assembly is comprised of a slider bed which contacts the underside of the moving conveyor belt which generates a friction force between the conveyor belt and the slider bed. Attached to the slider bed is a sensor which continuously measures the friction force and transmits data representing the measured friction force. A CPU receives and processes the representative data and provides a weight for the article on the conveyor belt.

U.S. Patent No. 5,543,610 to Bard et al. discloses a bar code scanning system including an optical scanner for scanning a target symbol, such as a bar code, and generating a corresponding electrical signal. The scanner housing may be mounted to a single finger ring support, which can be cylindrical in shape. The scanner housing may include a scanner activation switch, which may be of the voice recognition type. A transmitter for transmitting the analog or digitized electrical signal, either by wire or RF signal, to a receiver on the user's person is also included in the scanner housing. A decoder is preferably included within the receiver housing. The receiver housing may also have a display for displaying decoded data and a keyboard for inputting entry data. Signal processing circuitry for digitizing the electrical signals generated by the scanner may be included

either in the scanner or receiver housing. The receiver housing also may include an RF transmitter for transmitting the decoded data and any entry data to a separate computer unit. The receiver housing can be worn on the user's wrist or belt.

U.S. Patent No. 5,532,467 to Roustaei discloses an optical scanning head which includes at least one trio of light emitting diodes arranged so the LEDs emit light at different angles to create a fan of light. An optical module includes a light shield or "dark room" and a lens/filter assembly which provides control of the depth of focus of the scanner. The optical module is located behind the light source, and the detector, made up of a CCD array is mounted behind the optic module for detecting the light intensity in the reflected beam over a field of view across a bar code symbol. The CCD array generates an electrical signal indicative of the detected light intensity. A DC source or battery provides DC voltage to the LEDs and CCDs in response to a clocked signal which provides a gradual or sequential illumination of the LEDs and coordinates the activation of the CCDs in order to minimize power consumption during scans.

U.S. Patent No. 5,504,879 to Eisenberg et al. discloses a versioned data management system provided with method for resolving sources and targets of relationships. For each entity instance, a lifetime ID is recorded. When the add interface is used to add an entity, a value is assigned to the lifetime ID, which value has never been used before for an instance of the entity type. When the update interface is used to update an entity, the lifetime ID is maintained unchanged. If the update results in a new version, the new version is given the same lifetime ID value as that for the version that was the basis for the update. If the delete interface is then used to add an instance with the same part key, that instance will have a different lifetime ID. For each relationship instance, lifetime IDs are recorded for the relationship, its source, and its target. When the add interface is used to add a relationship, a value is assigned to the lifetime ID, which value has never been used before for an instance of the relationship type. Also, the lifetime Ids of the source and target of the relationship are recorded in the relationship instance. The lifetime ID of the relationship and the lifetime IDs of the source and target are maintained unchanged. If an update results in a new version of the relationship, the new version is given the same lifetime ID value as that for the version that was the basis for the update.

U.S. Patent No. 5,495,097 to Katz et al. discloses a tunnel-type scanning system having a plurality of optical scan units. Each optical scan unit includes means for emitting light toward an item bearing an indicia. Each optical scan unit also includes means for receiving light reflected from the indicia and generating signals corresponding to the intensity of the reflected light. Also provided is a central control unit which includes means for combining together signals corresponding to the signals generated by at least two of the scan units to fully decode information contained on the indicia.

U.S. Patent No. 5,448,727 to Annevelink discloses a system and method of logically and physically clustering data (tuples) in a database. The database management system of the invention partitions (declusters) a set of relations into smaller so-called local relations and reclusters the local relations into constructs called domains. The domains are self-contained in that a domain contains the information for properly accessing and otherwise manipulating the data it contains. In other words, the data objects stored in the domains may be stored in a particular domain based upon a locality-of-reference algorithm in which a tuple of data is placed in a domain if and only if all objects referenced by the tuple are contained in the domain. On the other hand, the data objects stored in a domain may be clustered so that a tuple of data is placed in a domain based on the domain of the object referenced by a particular element of the tuple. By clustering the related object data in this manner, the database management system may more efficiently cache data to a user application program requesting data related to a particular data object. The system may also more efficiently lock and check-in and check-out data from the database so as to improve concurrency. Moreover, versioning may be more readily supported by copying tuples of a particular domain into a new domain which can then be updated as desired.

U.S. Patent No. 5,412,198 to Dvorkis discloses a scanning arrangement in a scanner which is operative for repetitively scanning indicia having parts of different light reflectivity; for example, such as a bar code symbol, and also pertains to the operation of a scanning arrangement of that type at high scanning speeds in two-dimensional and multi-axes scan patterns. A resonance asymmetric scan element (RASE) in which a scan element, which is preferably constituted of a mirror, is in effect attached along the upper side edges thereof to oscillation-imparting spring-means and not at the center of mass of the mirror as heretofore. This allows for higher frequencies of operation for the scan element at lower encountered stresses in that the fast axis of rotation of the scan element or mirror; in essence, the axis of oscillatory rotation about which the mirror is rotated at high frequencies substantially coincides with its center of mass.

U.S. Patent No. 5,378,883 to Batterman et al. discloses a hand-held bar code reader with a two dimensional image sensor for omnidirectional bar code reading, which includes variable imaging optics, and flash illumination with variable flash illumination optics. A spotter beam is provided for aiming the hand held bar code reader at a bar code symbol. The spotter beam is also used to measure the range to said bar code from said hand held bar code reader and to determine the focal length of said variable imaging optics and variable flash illumination optics. The imaging optics are adjusted automatically to provide the correct magnification and focus of a bar code regardless of range to the label. The variable focal length flash illumination optics are used to concentrate illumination energy only in the field of view of the bar code reader. The flash illumination energy is conserved by measuring the ambient light and setting the level of flash

illumination energy in accordance with the measured level of ambient light. In such a manner, conventional, damaged, multiple, and stacked bar code symbols along with true two dimensional codes may be rapidly read over distances from under one foot to over several feet without having to align the bar code reader to the bar code.

U.S. Patent No. 5,373,148 to Dvorkis et al. discloses an optical scanner with a component for producing a beam scanning motion mounted on a first flexible strip or planar spring. One or more additional flexible strips, adjacent the first flexible strip, provide additional support to prevent droop by the first flexible strip under the weight of the scanning component. The additional flexible strips also frictionally damp the low frequency motion of the first flexible strip to prevent interference with scanning due to vibration induced from movement of the scanner by an operator. In two-dimensional scanners, where the component moves in two orthogonal directions at two different speeds, the additional strip type frictional damping is applied to the planar spring which provides the necessary flexible support for motion in the slow speed scanning direction. Also, two-dimensional scanners conforming to the present invention use a gain-guided visible laser diode oriented in a particular manner so that the astigmatism of the laser beam extends the working range by compensating for decreasing fast direction scan line density at points farther away from the scanner.

U.S. Patent No. 5,331,118 to Jensen discloses a method and system for determining the dimensional volume of a package by moving the package on a conveyor belt system over a horizontally disposed strip containing machine-readable indicia indicating units of incremental length along said strip starting from a zero point and by a vertically disposed strip containing machine-readable indicia indicating units of incremental length along said strip starting from a zero point. A horizontally disposed reader is above the horizontally disposed strip to read the uncovered indicia on the horizontally disposed strip and a vertically disposed reader able to read the uncovered indicia on the vertically disposed strip with a computer to determine the lowest uncovered incremental length measurement of the indicia on the horizontally disposed strip.

U.S. Patent No. 5,329,103 to Rando discloses two resonant cantilever beams oscillate in a sinusoidal pattern. Mirrors disposed on the oscillating ends of the cantilever beams are used to multiplex two scanning and collecting light beams. The cantilever beam parameters and mirror configuration are selected so that the scanning light beam is on the first mirror during the linear portion of its scan. As the first cantilever beam oscillates out of the linear portion of the sine wave, the deflection of the first mirror is just great enough to allow the scanning beam to strike the second mirror during the linear portion of the second mirror's scan. The process is repeated twice each cycle. The collection lens is large enough to receive the full aperture of both mirrors at all times. Multiplexing of scanning diodes is also accomplished by a controller circuit which

alternately enables diodes disposed on the ends of respective first and second cantilever beams during the linear portion of each sine wave oscillation.

U.S. Patent No. 5,319,185 to Obata discloses a bar code reader which has a sensor unit to be mounted on an operator's finger and a decoder unit to be mounted on an operator's wrist, the sensor and decoder units being electrically connected by a cable. The sensor unit has a light-emitting device for emitting light toward a bar code to be read, a graded-index rod lens array for focusing an entire linear optical image of the bar code at one time in substantially the same size as the bar code, and a line image sensor such as a CCD for photoelectrically converting the entire linear optical image focused by the optical means into an electric signal. The decoder unit decodes the electric signal from the line image sensor. The light-emitting device, the rod lens array, and the line image sensor are housed in a hollow casing. A movable tubular member is movably disposed in the hollow casing and has an end wall for abutment against the bar code. A switch for energizing the light-emitting device and the decoder unit is fixedly mounted in the hollow casing and triggerable by the movable tubular member when the movable tubular member is moved by abutment of the end wall thereof against the bar code.

U.S. Patent No. 5,319,181 to Shellhammer et al. discloses a method and apparatus for decoding a two-dimensional bar code symbol using a charge-coupled device (CCD) camera or a charge-modulation device (CMD) camera. The CCD/CMD camera takes pictures of the symbol and the picture is converted into digital data. The location and orientation of the two-dimensional bar code symbol is determined and verified. Defects and damages on the symbol are detected and corrected. The symbol is scanned to read the codewords of the two-dimensional bar code symbol.

U.S. Patent No. 5,296,690 to Chandler et al. discloses a bar code reader which includes an image capture means for storing a two dimensional image in memory, which stored image may include a bar code symbol within the field of view of the image. The bar code reader further includes method and apparatus for determining the location and orientation of the bar code symbol within the field of view of said image, and then filtering the located and oriented bar code symbol along an axis perpendicular to the detected orientation. Thereafter, the filtered bar code symbol is scanned and applied to a decoder to produce a decoded bar code output.

U.S. Patent No. 5,280,165 to Dvorkis et al. discloses a scan pattern generator for use in a bar code reader which uses a single drive (one coil and one magnet) to produce movement of a reflective surface so as to produce an oscillating movement of the surface in two directions, thereby forming a raster-type scanning pattern when a light beam is reflected off the surface.

U.S. Patent No. 5,224,088 to Atiya discloses a simple high resolution optical scanner

which consists of high numerical aperture lens mounted at the end of a flexible cantilever. The lens scans along a curved line as the cantilever bends. In order for the optical path to track the lens position, a mirror is mounted on the cantilever at a point located about 20% of the cantilever length, measured from the fixed mounting point. As the cantilever bends, the angle at this point is half of the angle at the cantilever end. Since the mirror doubles the angle when reflecting the input beam, the input beam will track, and stay parallel to, the lens at the end of the cantilever. This type of scanner is particularly suited to operate in a resonant mode, since the cantilever shape has low inherent damping.

U.S. Patent No. 5,220,536 to Stringer et al. discloses a method and apparatus for measuring the dimensions and determining the three-dimensional, spatial volume of objects. In the preferred embodiment, a light curtain and ultrasonic sensing are employed in combination with the travel time of linearly moving objects to ascertain object dimensions. The preferred embodiment is particularly suitable for measurement of moving, rectangular objects of random orientation with respect to the direction of travel.

U.S. Patent No. 5,212,390 to LeBeau et al. discloses a device which employs a laser diode and cylindrical lens to project a plane of laser at an incidence angle onto a plurality of leads. The light is simultaneously reflected from each of the plurality of leads. The light that is simultaneously reflected from each lead is detected by an image sensor. A digital computer computes the cotangent function of the incidence angle to detect an amount of displacement of at least one of the plurality of leads.

U.S. Patent No. 5,193,120 to Gamache et al. discloses a three dimensional imaging system having a diode laser and collimator along with a video camera and digital circuitry wherein when the light from the laser is collimated and hits the surface of an object with the reflected light images picked up by the video camera and the centroid location of each intersection is interpolated translating two dimensional pixels into three dimensional coordinates.

U.S. Patent No. 5,192,856 to Schaham discloses in Fig. 1 a hand-held imaging device for reading and interpreting bar codes which illuminates the bar code with a fixed elliptical light beam (produced by an LED and collimating and cylindrical lens), and images the reflected beam onto a linear CCD array which is aligned with the light beam. The black and white bar information is detected by the electronically scanned elements of a linear CCD array. The limited operational range, determined by the optical system depth of focus, is enhanced significantly to a useful operational range by automatically focusing the image of the bar code on the CCD array.

U.S. Patent No. 5,168,149 to Dvorkis et al. discloses high speed scanning arrangements in

scanners for reading bar code symbols by oscillating a scanner component mounted on an arm of an asymmetrical U-shaped spring in single or multi-axis scan patterns.

U.S. Patent No. 5,136,145 to Karney discloses a symbol reader that uses a dynamic random access memory as a detector element and a gradient refractive index material as the lens to capture a symbol image. The rod shaped lens passes through an opaque cover and confronts the array of memory elements in the memory. The cover is glued to a memory device package. The PN junctions of the random access memory are activated by light reflected from a symbol and appear as data when the random access memory is read out. The light can be provided by light emitting diodes positioned adjacent to the memory package and in a handheld wand that includes a light reflecting shield in which the symbol is positioned for reading. The wand is positioned over the symbol and a read button is depressed. A computer monitoring the read button activates the light emitting diodes and then reads out the contents of the random access memory, unscrambles the data, signals the user that the symbol has been captured and then outputs the symbol image.

U.S. Patent No. 5,080,456 to Katz et al. discloses a bar code scanner employing a laser source and scan mirror for generating a light beam for scanning a bar code symbol or the like. The working range for distance between the scanner and the symbol is extended by placing an optical element in the path between the laser source and the scan mirror. This optical element may be a figure of rotation such as an axicon. A slit may be positioned downstream of the axicon to block the characteristic concentric rings produced in the beam in areas perpendicular to the scan line.

U.S. Patent No. 5,076,690 to deVos et al. discloses a position sensing system which calculates the X-Y coordinates of a point using triangulation and determines the direction in which the point is moving. The triangulation calculation is based on the coordinates of at least three retroreflective elements spaced apart from each other around the periphery of a two-dimensional coordinate frame, and the measured angles between the lines projected radially outward from the point to each of the retroreflective elements. The accuracy of the measured angles is achieved by using a rotating member supported by dedicated hardware and controlled by software. The member rotates with a beam of light generated by a light transmitting and detecting device positionable at the point. The light transmitting and detecting device receives the beam of light reflected back from the retroreflective elements and generates an output signal in response thereto. A computer processes the output signal for use in calculating the X-Y position of the point and the orientation of the light transmitting and detecting device when it is positioned at the point.

U.S. Patent No. 4,979,815 to Tsikos discloses a range imaging system, and a method for calibrating such a system which are based on the principles of projective geometry. The system comprises four subsystems: (1) a laser and a cylindrical lens or vibrating mirror for producing a

planar beam of light; (2) an electronic camera equipped with a lens and an appropriate interference filter; (3) an electronic circuit for height (depth) measurements and video image generation; and (4) a scanning mechanism for moving the object with respect to the light beam and the camera so as to scan an area of the object surface. The system is calibrated by determining the position in the electronic image of the object surface at three different heights. The range image is generated from these three known heights from either a previously determined look-up table, or from a calculation based on the invariance of the cross-ratio, a well known ratio from projective geometry.

U.S. Patent No. 4,958,894 to Knowles discloses a beam sweeping apparatus for use in a scanning device. The apparatus comprises a mirror mounted on a pivot arm and arranged to be oscillated about an axis in an arc for sweeping a beam of light in a predetermined path. A pair of resilient are located adjacent the pivot arm to establish the limits of the excursion of the arm and mirror. A reversible electromagnetic motor is provided when energized for causing the pivot arm to move in alternate rotational directions until a portion of it engages a respective one of the bumpers, whereupon that bumper prevents further excursion of the arm in that direction and bounces the arm back in the opposite rotational direction. The energization of the electromagnetic motor is coordinated with the engagement of the bumpers by the pivot arm.

U.S. Patent No. 4,904,034 to Narayan et al. discloses a scanner including a source of coherent light, a radial hologon, a lens and a target. Between the light source and the hologon there are means for forming light from the source into a collimated beam having an oblong cross-sectional shape and for directing the beam onto the hologon at a predetermined incident angle and with the long axis of the oblong cross-sectional shape of the beam radial of the axis of rotation of the hologon. Prismatic means are provided between the hologon and the lens means for so modifying the cross-sectional shape of the beam that the spot at the target station has a selected shape and orientation. This allows the shape, orientation and size of the beam on the hologon to be optimum for duty cycle of the hologon and for spot size on the target. The prismatic means allows the spot shape and orientation on target to be optimized. The prismatic means tends to introduce undesirable bow into the scan line, therefore the wavelength of the light and the grating factor of the hologon are selected to produce an approximately equivalent opposite bow.

U.S. Patent No. 4,900,907 to Matusima et al. discloses a handheld reader for reading optical information such as a bar code contains a reading sensor. An image of the optical information is imaged by light produced by a pair of LEDs and reflected from the optical information, via a reflecting mirror, a lens and a diaphram member, onto the reading sensor so that the image is converted into an electric signal. The pair of LEDs are disposed on both sides of the image sensor so that the images thereof are imaged near the optical information by light from the

LEDs through the diaphram member, the lens and the reflecting mirror. The LEDs and reading sensor are controlled so that the LEDs are disabled from emitting light while the reading sensor performs the reading operation of the optical information.

U.S. Patent No. 4,826,299 to Powell discloses a lens which has the appearance of a prism with a relatively sharp radius at the apex. This lens finds an application in expanding a laser beam in one direction only.

U.S. Patent No. 4,717,241 to Aagano discloses a light deflection device comprised of a cantilever member, a light deflecting element provided near the fixed end of the cantilever member, and a means of imparting deflection to the free end of the cantilever member, so that the angle of inclination of the light deflecting element, and hence the angle of deflection of the light, can be set and controlled with very high precision by the controlled deflection of the cantilever member by said means.

U.S. Patent No. 4,687,325 to Corby, Jr. discloses a three-dimensional range camera system which measures distance from a reference plane to many remote points on the surface of an object. The set of points at which range is measured lie along a straight line (N points) or are distributed over a rectangular plane (MxN points). The system is comprised of a pattern generator to produce a 1xN array of time/space coded light rays, optionally a means such as a rotating mirror to sweep the coded light rays orthogonally by steps, a linear array camera to image subsets of the light rays incident on the object surface, and a high speed range processor to determine depth by analyzing one-dimensional scan signals. The range camera output is a one-dimensional profile or a two-dimensional area range map, typically for inspection and robotic vision applications.

U.S. Patent No. 4,632,501 to Glynn discloses a resonant electromechanical oscillator which includes a base portion, a driven portion, a cantilevered sheetform flexural suspension which spaces the driven portion from the base portion for oscillation about an axis in the plan of the sheet-form suspension, and an electro-magnetic drive which includes cooperating portions on the base and driven portions for oscillating the driven portion at a resonant frequency. The ends of the sheetform suspension are coupled to the base and driven portions with at least one end coupling being adjustable to select the resonant frequency of the oscillator by changing the effective length of the sheet suspension. Fixed surfaces on the base portion limit angular excursion of the driven portion and limit buckling distortion of the sheet-form suspension. Preferred embodiments of the oscillator have a driven portion with a mass in the range of two to ten grams, and withstand impact loads of at least five hundred g's. In particular, a rugged resonant scanner, capable of use in a portable device, is shown.

U.S. Patent No. 4,580,894 to Wojcik discloses a system for measuring the velocity of a moving image or object. As disclosed, the system comprises: a first array of sensors extending in a first direction transverse to image motion for sensing a primary set of image elements; a second array of sensors extending generally in the first direction and spaced a known distance from the first array for sensing successive sets of image elements; a device for correlating the primary set of image elements and for producing a correlation level indicating the level of correlation of the primary set with each of the successive sets; means for selecting one of the correlation levels which indicates an optical level of correlation; and means for determining the time interval between the sensing of the first array of the primary set and the sensing by the second array of the successive set corresponding to the selected correlation level; in addition, the means for correlating may include means for comparing with the primary set each successive set in a plurality of different positions along the first direction and for producing a comparison level indicating the level of comparison of the primary set with each of the successive sets in each of the different positions along the first direction; and means for determining the displacement between the position in which the successive set is sensed and the position corresponding to the indicated comparison level.

U.S. Patent No. 4,387,297 to Swartz et al. discloses an entirely field-portable laser scanning system for reading bar code symbols includes a light-weight and small-sized laser scanning head. The laser source, power supply component, optics, scanning elements, sensor circuit, and signal processing circuitry are specially designed for minimal size and weight and volume such that they can all be mounted in the head. The head can be bracket-mounted or hand-held. The housing for the head can be provided with a handle grip, or can be gun-shaped. High speed oscillating scanning motors and/or penta-bimorph scanners are used as scanning elements. A trigger initiates repetitive scanning of each object bearing a symbol, and an indicator indicates when the scanning of that particular object has been terminated. A body harness supports the remaining scanner system circuitry. A non-bulky, freely-movable cable interconnects the head to the body harness. Methods of scanning the symbol and of operating the system are also enclosed.

U.S. Patent No. 4,333,006 to Gorin et al. discloses a holographic scanning system for scanning bar code indicia in which the light beam of a laser is directed to a first set of holograms located on a single rotating disc in which each hologram will generate an individual scan beam having a slightly different focal length and direction angle from that of the other holograms. The generated scanning beams are directed on a target area through which passes a label or object bearing a bar code indicia. Each of the scan beams is projected in an overlapping relationship on the target area, thereby providing an enhanced depth of focus enabling a more effective reading operation. The light reflected from the bar code indicia is picked up by a second set of holograms mounted on the rotating disc and focused at a point at which is located an optical detector for use

in reading the bar code.

U.S. Patent No. 4,063,287 to Van Rosmalen discloses a tracking mirror device, in particular for a video disc player, in which for following an information track on a video disc with a beam of radiation, use is made of a mirror which oscillates at a high frequency, which causes the beam of radiation, which serves for scanning the information track, to oscillate transversely to the information track at a high frequency and a small amplitude, while the filtered-out high-frequency signal, as a function of its amplitude and its plase relationship with the high frequency voltage which is applied to the oscillating mirror, yields a control signal for following the information track. In accordance with the invention, use is made of an oscillating mirror which is driven electromagnetically and which is connected to oscillation compensation elements by means of springs which elements oscillate in phase opposition to the mirror. Thus, an oscillator mirror is obtained which can readily be excited to natural resonance and thus requires little power. On the mirror a piezo-electric miniature acceleration transducer can be mounted, which can provide a feedback signal so that the oscillating mirror can be included in a self-oscillating circuit.

U.S. Patent No. 4,044,283 to Allison discloses an electromechanical resonator for use in optical scanning systems. The resonator comprises a torsionally resonant system including a torsion rod having one end fixed to a modal zone member and an oscillatory mass at the free end. A flexurally resonant system includes a pair of oppositely disposed flexure arms extending transversely of the torsional axis and having their inner ends fixed to the modal zone member. The nodal zone member is suspended by a coupling spring from a frame member and the coupling spring permits energy transfer from the flexurally resonant system to the torsional resonant system through nodal zone member. The resonant systems are maintained in oscillation by electrodynamic means coupled with the flexure arms.

U.S. Patent No. 3,947,816 to Rabedeau discloses an omnidirectional optical system arranged for scanning bar coded labels passing a rectangular scanning window with a plurality of interlaced scans in a plurality of differing directions whereby the labels are completely scanned irrespective of orientation. The interlaced and plural directive scanning rays are generated by directing a beam of light, form a laser or like light source, onto a rotating multi-faceted mirror for deflecting the light beam in a line extending in a given direction. A set of fixed mirrors is positioned to deflect the light beam in a number of laterally displaced scanning segments all parallel to the line extending in the given direction. A pair of fixed end mirrors are arranged for reflecting the light from half of the segments back onto the other half of the segments to provide the intersecting scanning pattern. Beam splitting mirrors are interposed in the light beam from the laser for providing additional light beams directed onto the rotating mirror

U.S. Patent No. 3,671,766 to Howe discloses a mirror oscillating through an angular arc defined by arc terminal points. Springs associated with the mirror absorb the kinetic energy of halt at the terminal points and provide the primary driving force and energy to the mirror for reversing the direction of oscillation thereof toward the opposing terminal point. Magnetic means provides a source force to induce oscillation from dead stop and to supplement the spring action by compensating for frictional and other energy losses during operation. Means are provided to bias the mirror to one of the terminal positions when inoperative. The mirror is powered at each terminal point and freely moves at a substantially constant angular velocity between the terminal points.

WIPO Publication No. WO 01/71419 A2 by Accu-sort Systems, Inc., discloses a scanning system which utilizes a randomly addressable image sensor which is selectively positioned at the Scheimpflug angle in the image plane in order to detect focused light reflected from an object. Light reflected from the object is focused onto the sensor through an objective lens. Since the sensor is mounted at the Scheimpflug angle, each strip within the depth of field of the object plane has corresponding pixels on the sensors which are in focus.

WIPO Publication No. WO 01/2028 A1 by Accu-sort Systems, Inc., discloses a system for scanning objects having a linear array sensor, adapted to detect light input signals. A lens is optically connected to the linear array sensor, and is adapted to receive and transmit an optical image located in a field of view along a lens axis to the linear array sensor. A light source which generates an illumination stripe in general linear alignment with the lens axis is provided. A cylindrical lens is positioned between the light source and an object to be scanned. The cylindrical lens adapted to collect, transmit and focus light from the light source to form the illumination stripe.

U.S. Provisional Application No. 60/190,273 by Chaleff et al. publishes as WIPO International Publication No. WO 01/72028 A1, discloses an optical scanning system containing a coplanar camera utilizing a LED array light source and a linear CCD sensor array.

WIPO Publication No. WO 00/75856 A1 by Metrologic Instruments, Inc. discloses a fully automated package identification and measuring system, in which an omnidirectional holographic scanning tunnel is used to read bar codes on packages entering the tunnel, while a package dimensioning subsystem is used to capture information about the package prior to entry into the tunnel. Mathematical models are created on a real-time basis for the geometry of the package and the position of the laser scanning beam used to read the bar code symbol thereon. The mathematical models are analyzed to determine if collected and queued package identification data is spatially and/or temporally correlated with package measurement data using vector-based

ray-tracing methods, homogeneous transformations, and object-oriented decision logic so as to enable simultaneous tracking of multiple packages being transported through the scanning tunnel.

WIPO Publication No. WO 99/64980 by Symbol Technologies, Inc. discloses an imaging engine and signal processing devices and methods for reading various kinds of optical codes. The compact structure (54") may include a two-dimensional image sensor, apparatus for focusing images at different focal disclosures, a laser-beam type aiming system, a hi-low beam illumination system employing an array of LEDs on lenslet plate (50), and related signal processing circuits.

WIPO Publication No. WO 97/22082 to Schmutz et al. discloses a tunnel-type machine vision system which images bar code labels moving through a horizontal plane at variable object distances within the system's object depth of field with a plurality of sequential line images, each with difference object lengths which graduate into plural focused object planes, and the object plane within which the bar code label lies provides a focused optical image of the bar code to a multilinear photodetector which transduces the focused optical image into a corresponding electrical signal for further processing.

UK Patent Application No. GB 2 189 594 A discloses a system for measuring the volume of an arbitrarily shaped three-dimensional object, as the object is passed through a scanning plane on conveying means. The respective dimensions of the object in two perpendicular measurement directions in the scanning plane are measured at intervals during the passage of the object through the scanning plane by two electro-optical systems. The system calculates the cubical volume of the object by determining the area of a rectangle of minimum area that fits around the profile in one measurement plane and multiplying the area of the minimum rectangle by the maximum dimension of the object perpendicular to the one measurement plane obtained from the profile in the other measurement plane.

The Intevac Product Brochure for the Model 120 LIVAR® Short Wave IR Gated Camera describes a range-gated, laser-illuminated, two-dimensional imaging system that operates in the "eye-safe" wavelength band.

The weblink for the Intevac New LIVAR® Imagery system (http:www.intevac.com/livar_imagery/livar_imagery.html) exhibits the Laser Illuminated Viewing and Ranging (LIVAR®) system which is designed for range-gated imaging in the 1.5μm band.

The StockerYale Product Brochure for the Lasiris™ SNF Laser describes Lasiris™ SNF beam shaping optics which transforms the familiar laser dot into different shapes and sizes. For example, a straight line can be projected by allowing one dimension of light to fan out while

maintaining tight control over the other, resulting in a sheet-of light. This laser system incorporates an optical line generator that eliminates gaussian distribution of the light.

The Accu-Sort® Product Brochure for the AV3700 High Speed CCD Bar Code Reader describes a CCD camera that can be mounted over the belt or for side- and bottom-read applications. A new low-power, high-intensity LED-based illumination option, which can be used with the AV3700 reader, offers the same image quality and read rate performance as the standard sodium vapor lamps, and eliminates glare for side and bottom reading.

The DALSA, Inc. Product Brochure for the DALSA IT-P4 Image Sensors feature 4096, 6144, or 8192 elements and use proprietary technology to provide four outputs at 40MHz each. The DALSA IT-P4 Image Sensor employs buried channel CCD shift registers to maximize output speed and reduce noise. The IT-P4 sensor has a dynamic range of >1600:1 and a linear dependence on light level up to saturation. The exposure control of the IT-P4 sensor allows integration times shorter than the readout time.

The Eastman Kodak Company Product Brochure for the KAF-4202 Series Full-Frame CCD Image Sensor describes a high performance monochrome area CCD image sensor with 2032 H x 2044V photo active pixels designed for a wide range of image sensing applications in the 0.4nm to 1.0nm wavelength band. Typical applications include military, scientific, and industrial imaging. A 74dB dynamic range is possible operating at room temperature.

The Camera User's Manual for the DALSA Piranha CT-P4, CL-P4 High-Speed Line-Scan Camera describes a modular camera which uses the reliability, flexibility, and cost-effectiveness of high-volume interchangeable parts. Within the Piranha camera, a timing board (PB-P1-X206) generates all internal timing and a driver board (PB-P1-X139) provides bias voltages and clocks to the CCD image sensor. For enhanced dynamic range, one or two A/D board (PB-xx-D344) process the video and digitize it to 10 bits before outputting the most significant 8 bits.

The Sony Product Brochure for the ICX085AL Progressive Scan CCD Image Sensor Chip describes a 2/3-inch interline CCD solid-state image sensor with a square pixel array. Progressive scan allows all pixel signals to be output independently within approximately 1/12 second. This sensor chip features an electronic shutter with variable charge-storage time which makes it possible to realize full-frame still image without a mechanical shutter. High sensitivity and low dark current are achieved through the adoption of HAD (Hole-Accumulation Diode) sensors.

The Mitsubishi Product Brochure for the ML1XX6 series laser diodes describes a high power AlGaInP semiconductor laser which provides a stable, single transverse mode oscillation

with emission wavelength of 658-nm and standard CW light output of 30mW.

The April, 1999, Accu-Sort brochure entitled "Tunnel Scanning System" discloses a fixed position tunnel scanning system for use in high speed, high volume sortation systems. As disclosed, the tunnel system employs (i) an Accu-Sort Omni-X or Quad-X laser scanning x-pattern omnidirectional barcode reader arranged about a conveyor belt, and (ii) a Model 4800/5800 controller for muliplexing information produced from the scanners in the tunnel array, as well as photo-eyes and tachometers mounted at the level of the conveyor belt.

The October, 1998, Cargoscan brochure (15 pgs.) entitled "Dimensioning the Right Way: Reliably" discloses fundamental principles and consideration when dimensioning of objects using laser camera triangulation techniques.

The January, 1998, Accu-Sort brochure entitled "The Mini-X" describes the Accu-Sort Mini-X laser scanning x-pattern scanner which generates a single x-pattern using a single solid-state visible laser diode. As disclosed, the Mini-X scanner has two serial ports, photo-eye tachometer, and relay connections.

The 1997 paper entitled "Omni-Scan Tunnel" published by the United States Postal Service (USPS) discloses the general solution specification (called "Omni-Scan Tunnel) for the problem of reading bar code symbols placed on packages, USPS trays and tubs, and other USPS customer mailed products.

A separate listing of the above references on PTO Form 1449, hard copies of all foreign and technical publications, and a compact disc containing copies of all U.S. publications (in .pdf format) are enclosed herewith for the convenience of the Examiner.

The Commissioner is authorized to charge any fee deficiencies or overpayments to Deposit Account No. 16-1340. A copy of this page is enclosed herewith.

Respectfully submitted,

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